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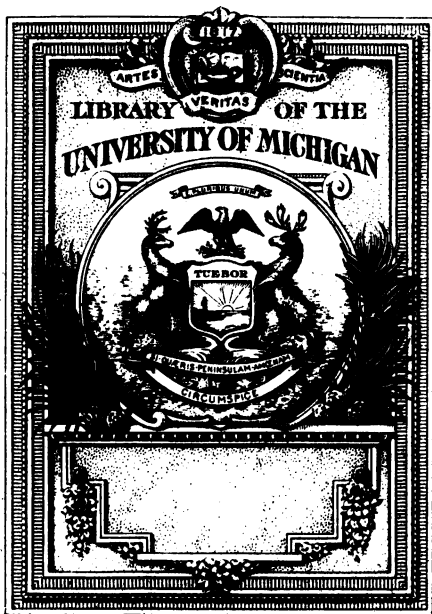
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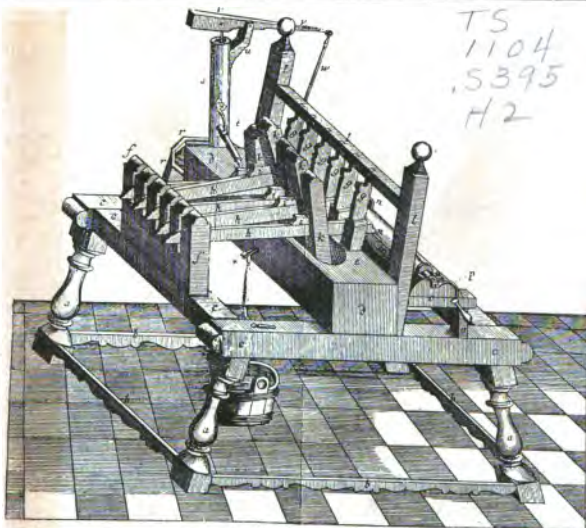
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THE GIFT OF
Mr. Wm. B. Wheelwright

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Jacob Christian Schäffers,
Doctors der Gottesgelarheit und Weitweisheit; Ev. Predigers
zu Regensburg; Sr. Königl. Majestät zu Dänemarf Rathes und
Professors; der Academien der Naturforscher, Großbritannischen,
Nordischen, zu Petersburg, London, Berlin, Venedigo, München
und Mannheim, der Gesellschaft der Wissenschaften zu Duisburg, hi-
storischen zu Göttingen, physischbotanischen zu Florenz, oeconomischen
zu Bern, Celle, Oberlausitz, und Grätz in Steyer, wie auch verschie-
dener deutschen Gesellschaften Mitgliedes; der Academie
zu Paris Correspondentens

sämmtliche
Papierversuche.

Sechs Bände.
Dzweite Auflage.

Nebst
ein und achtzig Mustern
und
drenzen
theils illuminirten theils schwarzen
Kupfertafeln.


Regensburg,
Gedruckt mit Zunkelischen Schriften.

1 7 7 2.



Mr. Wm. B. Wheelwright,

THE INVENTION OF WOOD PAPER

The experiments of Dr. Jacob Christian Schäffer, scholar and preacher, as related in his now extremely rare book, "Papier-versuche."

BY DR. ZOLTAN HARASZTI

Written especially for "ALFELCO FACTS"

ONE of the most characteristic features of the modern era is the tremendous amount of printed matter which appears every year. While a few hundred years ago, reading was the *privilege* of a small number only, there is no class to-day for which reading is not a *necessity*. Everybody is a reader in our time, and the newspaper — in ways visible or invisible — is a dominant factor in life.

The undreamed-of development of the press began approximately at the middle of the last century, when new democratic constitutions raised the lower and larger strata of the population of the European countries to the reading level, so that in a decade or two the number of readers was many times multiplied.

The new stirring of democratic life began in the fifties (in America, too, shortly before the Civil War) and *this was exactly the time when — with the rapidly growing demand for paper for the daily press — paper-making from wood began to come into practice*. This idea was already nearly one hundred years old, yet it had not called forth much interest before. The discovery was known, but nobody cared for it. And — only at first sight is this strange. The same thing happened in this case as with the discoveries of other arts or trades. For we must remember that within the natural limitations human *need* directs human progress, — human need is the "force motrice" which leads to new discoveries. And this is the fact which the inventor

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of wood paper — Jacob Christian Schäffer — alludes to in his book about the paper experiments.

A most eminent scholar, and above all, a most respectable man, was Jacob Christian Schäffer — a “doctor der Gottesgelarheit und Weltweisheit,” as he signs himself — a preacher, professor, and member of academies from St. Petersburg to London, from Berlin to Paris, to say nothing of a dozen smaller learned societies. His book — “*Sämmtliche Papier-versuche*,” as it runs in the original — is extremely rare to-day. In America there are only two copies we know of. One of them belongs to the *Library of the University of Michigan*, and the other to the *Smithsonian Museum*.

The book itself consists of six volumes. The first edition was published in Regensburg, 1765. It contains detailed description of all the experiments of the Doctor, the description of his *own* experiments, for Doctor Schäffer left aside for a number of years his ponderous volumes of cavilling science, learned the actual business of paper-making, and personally conducted the experiments.

Thus the book is the result of a happy combination. Doctor Schäffer, the author, gives a precise account of all the findings of Herr Schäffer, the paper-maker. The parts which depict his first struggle with the idea, while giving a general view of his whole conception, have even to-day a certain personal touch which cannot fail to impress us. *The excerpts we publish appear in English for the first time.*

“It is generally known” — begins the Doctor’s book — “that the paper which, according to all evidence, has

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been used in Europe since the twelfth century, is made of rags and worn-out linen. And the dearth of this material is now complained of everywhere. The most curious thing is that not only a certain kind of paper is wanting; statements of merchants reveal that in regard to wrapping paper, card board, etc., the want is even greater.

“This general lack of paper, and the harm done thereby to administration, science, and commerce, brought a few years ago to my memory what various scholars — like *Seba*, *Réaumur*, *Guétard*, *Gleditch*, and others—had in mind and proposed in regard to paper-making. They believed and with probability proved, that one is not exclusively bound in paper-making to linen, but can make paper just as well of a great many other things. It is generally known that rags are originally made of lint and hemp, which are plants themselves; thus, these scholars came to the conclusion that every material which —like hemp and lint—consists of such soft, elastic, easily separable fibres as through the action of water turn to pulp and, by drying, attain a certain stiffness and firmness, must be fit for paper-making.

“Few objections can be reasonably raised against the statements of these scholars,—and the more certain it is that besides hemp and lint there are many plants having the same necessary qualities, the more difficult it is to comprehend why those ideas have not been used for the public benefit, and why such experiments have not been longer, oftener, and in a more satisfactory way pursued.

“This regrettable neglect induced me three years ago to get to work with all possible energy. It seemed to me as if

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nature itself wished to encourage me in my task. Taking a walk outside of our city, chance led me to a place where one side of the field from abundance of pappus of poplar, and the other from *wool-blade*, looked wholly white. At this sight the thought flashed through my mind: *Could not paper be made from these plants?*

"Without losing time, I started at once to experiment. I gathered the pappus as well as the wool-blade, then talked the matter over with the paper-maker of our town, *Herr Meckenhäuser*. How happy I was when — after examining the pappus — this good-natured man declared that, though the wool-blade did not seem to him fit for paper-making, the poplar-downs must by all means be tried out.

"But my joy was gone when I learned that the paper-maker wanted five to twenty pounds of pappus. It was impossible to get such a quantity, and it cost me a great deal of talk before I could persuade him to make the experiment with the poplar-downs in a mortar.

"*A few days later I received a few samples of the new paper.* It was, at any rate, paper; one could print or even write on it. Only, it was too ragged, and did not possess the necessary firmness, and, besides, it was full of little brown knots, the residue of the pounded kernels. Yet these first and imperfect samples provided the most convincing proof that the pappus of poplar is fit for paper-making; and the paper-maker assured me, that if a satisfactory quantity of pappus had been pounded in his regular beater instead of in a mortar, and if it had been further duly

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treated and finished, we could have obtained a reliable and usable paper.

"Other occupations prevented me continuing my experiments in the following two years. Yet being urged from several sources, especially by the Academy, I resumed the experiments. I gathered again a basketful of poplar-pappus and wool-blade, and gave it to the same paper-maker.

"After a while I obtained paper from both species.

"The wool-blade paper came out unusually poor. It was extremely brittle,—all expense and labor seemed to be spent in vain. Nevertheless, I wondered whether there could not be made better paper of wool-blade. It was evident that the wool lay too long in the lime, and its excessive brittleness and rigidity were caused by the lime and not by the nature of the material. And I was anxious to know whether the next experiment supported my supposition.

"The paper made of pappus of poplar was incomparably the better. It was a perfectly good writing paper, lacking nothing but a little more white to be taken by everybody for rag-paper. I noticed too that the sheets differed in color. I now selected three different kinds. The first was dirty-white, the second gray, and the third yellowish. Could this difference in color be caused by the pappus itself? This seemed unlikely to me. I thought rather that the cause must be sought in the process of making. And I was not mistaken. For, to my questions, the paper-maker avowed that he worked at three different times on the

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paper, and consequently one portion lay longer in the lime than the other. Could I not conclude from this that the gray and yellow colors had accidentally developed and that with better care a better quality could be produced?

"I honored myself by submitting these new and good samples to the *Bavarian Academy*, and without any delay, I made preparations for experiments with all the materials which I thought might be fit for paper-making. And since my former experience convinced me that my aim would be very slowly and with double expense — if at all — reached if I depended on the paper-maker alone, *I decided myself to make all the experiments, from beginning to end, in my own home.*"

Doctor Schäffer then relates how he learned the paper-maker's trade. After securing all the necessary tools, he hired a journeyman who showed him — and in his presence, his servants — the process of paper-making.

"And I started again to make paper" — concludes the story of the brave Doctor — "from poplar-downs, and shavings, and sawdust, and so forth. And what sweet satisfaction did I feel when I saw that everything came out better than I had imagined! In a short time I was able to produce a reliable new sort of paper. After such success, how could I forbear to make new and again new experiments? — especially when the cost of the tools and the studying of the process had already been met. I decided therefore to make these experiments my regular winter occupation. I could do so the more readily since the paper made hitherto found the warmest acknowledgment and I was urged to continue my experiments. . . ."



Two of Doctor Schaffer's Eighty-seven Varieties

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For this is always so when theologists and philosophers lend themselves to worldly affairs. Professor Schäffer was soon lost for the "Gottesgelarheit," but the "Weltweisheit" gained the more by it. The six slender volumes of his book — with the accounts of *not less than eighty-seven different experiments* — prove with what diligence he pursued his "Papier-versuche." From the willow to the moss, from shavings to aspen, from sawdust to hop-tendrils, nothing was left untried by the new paper-maker. Often — as he admits himself — he was driven only by curiosity, for he knew in advance that on account of the scarcity of the species, it would be in any event impossible to use them for practical purposes.

As mentioned above, it took nearly a century before the discovery gained general recognition. The reasons are obvious. The scarcity of paper, complained of by Doctor Schäffer was temporary, due only to the wars of Frederick the Great. After the wars, the supply proved to be sufficient again. The new, rapidly increasing demands of modern life had to come to unearh his discovery. Then wood-paper became at once of the greatest importance. To-day, needless to say, it would be unthinkable to attempt to get along without it.

Now, we must not pass over in silence the fact that the book of Doctor Schäffer is not printed on wood-paper either. That would be too much to expect from its very discoverer. Yet the samples appended to the volumes convince us of the honest results of the experiments. Many of the eighty-seven specimens would serve well for printing.

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HOW TO RUN FELTS MOST EFFICIENTLY

The Papers entered for the Prize Contest were submitted without the names of their authors to a committee of paper makers. In the opinion of the majority, the following article by Harry Deffew of the Standard Paper Mfg. Co. was the most meritorious in a really close competition, and has been awarded first prize.

A number of the other good papers will be published later in whole or in part.

TOO many paper makers measure the efficiency of a felt by the number of days or weeks it has been on the machine, or by the tonnage made on a certain felt.

Of course, these items must be taken into consideration, but there are other features just as important. Are your felts delivering the goods while they are running that certain length of time, or making that certain tonnage? Are they removing the maximum amount of water from your paper, or are they leaving half of their work for the next felt or dryers to do, thereby wasting coal? Are your felts helping you to get that desired finish, helping to eliminate the wire mark, or felt mark? All of these things must be considered regardless of whether it is a first, second, or third Press Felt, or if it is a Fourdrinier, Cylinder, Harper, or whatever type machine you have.

I believe the first thing to do to obtain the highest degree of efficiency from a felt is to get the right felt. No man can do a carpenter's work with a blacksmith's tools, neither can a machine tender efficiently run coarse paper with a fine felt, or vice versa. No one would be foolish enough to go to those extremes, but there are many machines running to-day with not quite the right felt for their conditions.

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I think the surest way to get the right felt is for the Mill Superintendent to acquaint the Felt Manufacturer with the mill conditions, and grades of paper, etc. With the aid of his past experience, the Felt Manufacturer will supply you with a felt to meet your requirements. There is no one who could help you more with your felt problem. The Felt Manufacturer is making felts every day to suit all kinds of conditions. There is no one who would be more conscientious in helping you, because it is to the interest of his reputation to supply you with a felt which will give you maximum service under your conditions.

Another important thing is the mechanical condition of your machine. Whatever the type of machine, there is so little difference as to the proper care of felts. Seeing that Straight Fourdriniers are in the majority, we will take them for example.

As far as felts are concerned, the condition of the machine starts at the Couch Rolls. With a suction couch roll, as far as I know, all that can be done to help felts is to supply suction enough (as far as is practical) to have paper as free from moisture as possible, before it reaches felts.

Where a top couch roll is used, a good quality couch roll jacket and an evenly fitting guard board should be used for the same purpose. Top and Bottom couch rolls should be kept in perfect line, so that a uniform amount of water is squeezed from the paper the entire width of sheet, when top roll is weighted evenly on each side. If this is not taken care of, one part of the sheet will retain more moisture

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than another, causing felts to become dirty quicker at one place than another, resulting in too frequent washing.

Press rolls same as couch rolls should be kept in line and proper crown be kept on bottom rolls to insure an even pressure the entire width of sheet. Where bottom rolls are rubber covered, the rubber should not be too hard, or too soft. If it is too hard, you are not reaping the benefit of having a rubber roll, and will cause a too rigid pressure on felt, especially if you "turn" a felt on machine or if felt should "run ashore" it would probably "chew" too easily. If rubber is too soft, it is liable to lose its crown and general dimensions, again, more especially where felts are washed and turned on machine.

All top press rolls should have snug fitting doctors, which should be kept oscillating, or else top roll will become covered with ridges, which will mean uneven pressing. Doctors should have backs high enough, so that "broke" cannot easily fall over top and cut felt.

Save-all pans should have splash boards high enough to catch all water splashes, these splashes will "fill up" felt, resulting in too frequent washing.

Felt rolls whether made of wood or brass or rubber covered, should be perfectly smooth and must be exactly the same diameter the entire length of roll, or felt will become slack in places by continually running over or around a place larger than balance of roll. Felt rolls should be placed so that felt cannot "rub" on another part of felt, shower pipe, or anything else, on its way of travel, or nap will soon be gone from felt.